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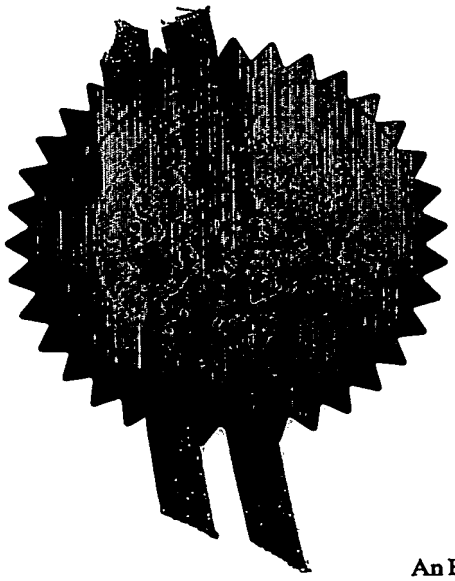

Signed Stephen Hordley

Dated 4 August 2003

Patents Form 1/77

Patents Act 1977
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19 JUL 2002
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P01/7700 0.00-0216787.2

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference 4635N/JAK

2. Patent application number *(The Patent Office will fill in this part)* 0216787.2 19 JUL 2002

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Pilkington plc
Prescot Road
St Helens
Merseyside
WA10 3TT

Patents ADP number *(if you know it)* 6604490001

If the applicant is a corporate body, give the country/state of its incorporation England

4. Title of the invention LAMINATED GLAZING PANEL

5. Name of your agent *(if you have one)* Anthony Charles HALLIWELL

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Group Intellectual Property
Pilkington plc
European Technical Centre
Hall Lane,
Lathom, Ormskirk
Lancashire L40 5UF

Patents ADP number *(if you know it)* 8063141001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
-	-	-

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*
-	-

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	5
Claim(s)	2
Abstract	1
Drawing(s)	2 +2

10. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature N.E. Pettet Date 18/7/02

Nicholas Edward Pettet in the absence of Anthony Charles Halliwell (Agent for the Applicant)

12. Name and daytime telephone number of person to contact in the United Kingdom: Mr J A Knowles - 01695 54391

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Laminated Glazing Panel

The present invention relates to laminated glazing panels. More particularly, the present invention relates to laminated glazing panels comprising two glass plies and a plastics ply.

Laminated glazing panels usually comprise two glass sheets and a plastics sheet (usually of polyvinylbutyral) sandwiched between the glass sheets, i.e. the plastics sheet extends between the glass sheets and is substantially co-extensive with them. The plastics sheet is often referred to as an interlayer. Laminated glazing panels find uses in windows, (especially vehicle windows) in doors and in screens.

Laminated glazing panels are usually produced by a lamination process comprising subjecting the glass/interlayer/glass plies to relatively high temperature (typically exceeding 100°C) and pressure (typically exceeding 5 atmospheres) in an autoclave. During the lamination process, the interlayer tends to creep or flow which ensures good contact with the glass plies and consequently good optical properties. Laminated glazing panels may also be produced by a cast-in-situ process in which a fluid interlayer material is introduced between glass plies and cured in situ (e.g. by heat or ultraviolet radiation) to produce a plastics interlayer. Cast-in-situ processes are not preferred for the production of laminated glazing panels because the mechanical and fracture properties of the laminate tend not to be suitable to be used in windows, doors or screens.

It is often advantageous to provide laminated glazing panels with devices which improve the utility of the panel, for example, indicators, lights or sensors. US 3 317 906 discloses an improved safety laminate having instrument indicators means incorporated therein. The indicator means disclosed include an electro-magnetically operated needle and a calibrated scale sandwiched between a pair of panels in a circular space provided within the plastic interlayer.

However, devices more sensitive than the robust devices disclosed in the prior art are often damaged by the high temperature and pressure of the lamination process, or by the means used to cure a cast-in-situ interlayer material.

Surprisingly, the inventors have discovered that light emitting diodes laminated between the glass plies can survive the lamination process.

The present invention accordingly provides a laminated glazing panel comprising two glass plies and a plastics ply, wherein a light emitting diode is laminated between the glass plies.

It is surprising that light emitting diodes survive the lamination process because light emitting diodes are prone to failure mechanisms which occur at high temperatures and pressures. For example, boiling of stray moisture or expansion of air or gas pockets and mismatch between thermal expansion coefficients can detach electrical connections or otherwise damage the device. It had been thought that light emitting diodes would be attacked and damaged by moisture or plasticiser present in the plastics films used in lamination.

It is advantageous to laminate light emitting diodes (LEDs) because LEDs may be used as indicating devices and may produce relatively intense light at a variety of wavelengths. Intensity of light can be important, for example, when the panel is used as a window and the indicating device needs to be visible against external illumination. Furthermore, LEDs have high lifetimes comparable to the expected lifetimes of a laminated glazing panel.

Preferably, the laminated glazing panel further comprises connecting means for connecting the light emitting diode to a power supply. The connecting means may comprise at least one connector on the inner surface of a glass ply. Visually unobtrusive connecting means, for example thin surface coatings of metal or conductive metal oxide are most preferred.

At least one of the plies may comprise a cut-out on an edge thereof to aid connection of the light emitting diode to the power supply.

The light emitting diode laminated between the glass plies is preferably mounted on a circuit board. Whether or not a mounted light emitting diode is used, preferably a connector (which may be a connector portion of the circuit board) projects beyond the laminated glazing to aid electrical connection.

The light emitting diode may be used without modification (i.e. mounted for conventional electronic assembly, for example mounted and electrically connected on a flexible circuit board). Even more surprisingly, such conventionally mounted light emitting diodes can also survive the lamination process despite problems associated with e.g.

boiling of plasticiser which had been thought likely to cause rupturing of the device and/or mounting.

The material of the circuit board should adhere well to the laminate interlayer so that the overall strength of the laminated glazing panel is not significantly reduced. Materials less susceptible or impervious to moisture are preferred because any circuit material has the potential to transport moisture into the laminate which then alters the interlayer materials strength, bonding and ability to dissolve gases.

The material of the circuit board may generally be of any suitable colour or degree of light transparency. However, substantially transparent materials (e.g. polyester) are preferred to achieve high light transmission and low visibility of the circuit.

Usually, the plastics ply will comprise a polyvinylacetal, preferably polyvinylbutyral. Preferably, the plastics ply has a thickness before lamination of 2 mm or lower, and more preferably the plastics ply has a thickness before lamination of 1 mm or lower, most preferably of about 0.8 mm. The light emitting diode will generally have a thickness less than the thickness of the plastics ply so that it is substantially enclosed after lamination. This is advantageous, because such thin plastics plies enable thin laminates to be constructed, the preferred thickness of the laminated glazing panel being 8 mm or lower.

Depending upon the intended use of the laminated glazing panel, a plurality of light emitting diodes may be laminated between the glass plies. A plurality of LEDs (for example arranged in an array) allow text or other relatively complex information to be indicated on the panel. Alternatively, LEDs may be arranged around part or the whole of the periphery of the laminated glazing panel to provide an illuminated outline of the panel for safety or aesthetic reasons. To improve the utility of such a panel further, the panel may further comprise indicia on at least one ply to convey information relating to the light emitting diode, or which alter the visual appearance of the device when in the finished laminated glazing panel.

In another aspect, the present invention provides a process for the production of a laminated glazing panel comprising encapsulating a light emitting diode in a plastics ply between two glass plies.

In a further aspect, the present invention also provides a process for the production of a laminated glazing panel comprising sandwiching a plastics ply between two glass plies, and laminating the plies, characterised by placing a light emitting diode between the glass

plies before lamination. Preferably, at least part of the plastics ply is shaped, before lamination (e.g. by indentation, stretching or cut-outs) to aid in retaining the light emitting diode.

Laminated glazing panels according to the present invention have many uses including in a window, door or screen. The light emitting diodes enable laminated glazing panels to be provided with various functions. Examples of such functions include: illumination, light emitting diodes as indicia to convey information or to provide an aesthetic function by defining images (including moving images), and sensors including moisture sensors (for example, optical moisture sensors) and proximity sensors.

The invention is illustrated but not limited by the following drawings in which:

Figure 1 illustrates in section a light emitting diode laminated in a laminated glazing panel.

Figure 2 illustrates in plan view a light emitting diode mounted on a flexible circuit board.

Figure 3 illustrates arrangements of light emitting diodes for use as indicia as they would appear once laminated in a laminated glazing panel.

Figure 1 shows a light emitting diode 2 laminated between an upper glass ply 4 and a lower glass ply 6. The light emitting diode is positioned in a polyvinyl butyral ply 8. Electrical connection to the light emitting diode can be made using the electrical connector 10.

Figure 2 shows the light emitting diode 2 mounted on a flexible circuit board 12 (supplied by Nitto UK Ltd) before lamination. The light emitting diode 2 may be connected to a power supply (not shown) using the electrical connectors 10.

Figure 3 shows examples of indicia which may be provided on a vehicle (e.g. a car) windscreen. Each of the exemplified indicia incorporates one or more light emitting diodes laminated in the windscreen in accordance with the invention. Figure 3(a) illustrates two 5 by 7 arrays 14, 16 of light emitting diodes. Using appropriate electronic addressing and measurement of vehicle speed, the arrays indicate the speed of a vehicle, in this case indicated by the number 30. Figure 3(b) illustrates a printed indicium 18 representing oil. When lit, the light emitting diode 10 provides a low oil warning. Figure 3(c) illustrates a printed indicium representing fuel. When lit, the light emitting diode 10 provides a low fuel warning. Figure 3(d) illustrates a printed indicium representing a lock. When lit, the

light emitting diode 10 provides an indication that the vehicle is locked. Figure 3(e) illustrates a printed indicium representing a vehicle alarm. When lit, the light emitting diode 10 provides an indication that the vehicle alarm is on.

In the case of alarm or warning indicia it may be desirable to flash the light emitting diode to draw the users' attention. The printed (i.e. graphical) part of the indicia may be printed on to any of the glass surfaces of the laminate or on the surface of the circuit board.

The flexible circuit boards can be made in a variety of forms with multiple conductive track layers and insulator substrate layers. The light emitting diodes are preferably thinner than the plastics ply, thus are preferably thinner than 1 mm or so. Suitable light emitting diodes can be obtained as articles of commerce, for example in red, green, yellow, orange, orange-red, yellow-orange and deep red colours (from e.g. Idea, Inc. of Brea, CA, USA).

A laminated glazing panel according to the invention may be manufactured as follows. A ply of polyvinylbutyral (PVB) is laid on a glass ply. A flexible circuit board 12 with a light emitting diode 10 is laid on the PVB ply and positioned as desired. A second ply of PVB is laid on top of the flexible circuit board 12 and light emitting diode 10. Optionally an indentation or partial or whole cut out may be made in one or both of the PVB plies corresponding to the shape of the flexible circuit board 12 and light emitting diode 10. A second glass ply is laid on top of the second PVB ply. The laminate is de-gassed and autoclaved under the usual conditions well known in the art, typically at a temperature of about 100°C and pressure of about 5 atmospheres.

CLAIMS

1. A laminated glazing panel comprising two glass plies and a plastics ply, wherein a light emitting diode is laminated between the glass plies.

2. A laminated glazing panel as claimed in claim 1, further comprising connecting means for connecting the light emitting diode to a power supply.

3. A laminated glazing panel as claimed in claim 2, wherein the connecting means comprises at least one connector on the inner surface of a glass ply.

4. A laminated glazing panel as claimed in either claim 2 or claim 3, wherein at least one of the plies comprises a cut-out on an edge thereof to aid connection of the light emitting diode to the power supply.

5. A laminated glazing panel as claimed in any of the preceding claims, wherein the light emitting diode laminated between the glass plies is mounted on a circuit board.

6. A laminated glazing panel as claimed in any of the preceding claims, wherein the plastics ply comprises a polyvinylacetal.

7. A laminated glazing panel as claimed in any of the preceding claims, wherein the plastics ply comprises polyvinylbutyral.

8. A laminated widow as claimed in any of the preceding claims, wherein the plastics ply has a thickness before lamination of 2 mm or lower.

9. A laminated glazing panel as claimed in claim 8, wherein the plastics ply has a thickness before lamination of 1 mm or lower.

10. A laminated glazing panel as claimed in any of the preceding claims, wherein the thickness of the laminated glazing panel is 8 mm or lower.

11. A laminated glazing panel as claimed in any of the preceding claims, wherein a plurality of light emitting diodes is laminated between the glass plies.

12. A laminated glazing panel as claimed in any of the preceding claims, further comprising indicia on at least one ply.

13. A process for the production of a laminated glazing panel comprising encapsulating a light emitting diode in a plastics ply between two glass plies.

14. A process for the production of a laminated glazing panel comprising sandwiching a plastics ply between two glass plies, and laminating the plies, characterised by placing a light emitting diode between the glass plies before lamination.

15. A process for the production of a laminated glazing panel as claimed in claim 14 wherein at least part of the plastics ply is shaped to aid in retaining the light emitting diode.

16. Use of a laminated glazing panel as claimed in any of claims 1 to 12, in a window, door or screen.

17. A laminated glazing panel substantially as hereinbefore described with reference to, and as illustrated in, Figure 1 of the accompanying drawings.

18. A process for the production of a laminated glazing panel substantially as hereinbefore described.

ABSTRACT

Laminated Glazing Panel.

A laminated glazing panel is disclosed comprising two glass plies and a plastics ply having a light emitting diode laminated between the glass plies. The light emitting diode may be mounted on a circuit board. Preferably, the plastics ply has a thickness before lamination of 2 mm or lower and the thickness of the laminated glazing panel is 8 mm or lower.

In one embodiment a plurality of light emitting diodes is laminated between the glass plies and the glazing panel may further comprise indicia on at least one ply.

Also disclosed is a process for the production of a laminated glazing panel comprising sandwiching a plastics ply between two glass plies, and laminating the plies, characterised by placing a light emitting diode between the glass plies before lamination.

Laminated glazing panels of the invention may be used in a window, door or screen.

Figure 1

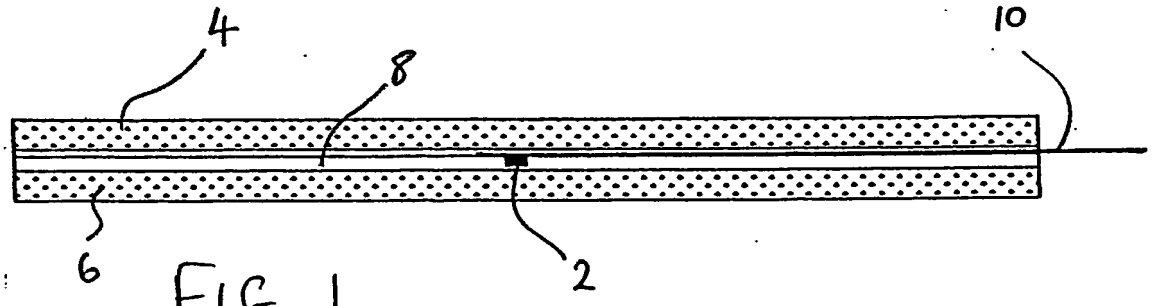

FIG 1

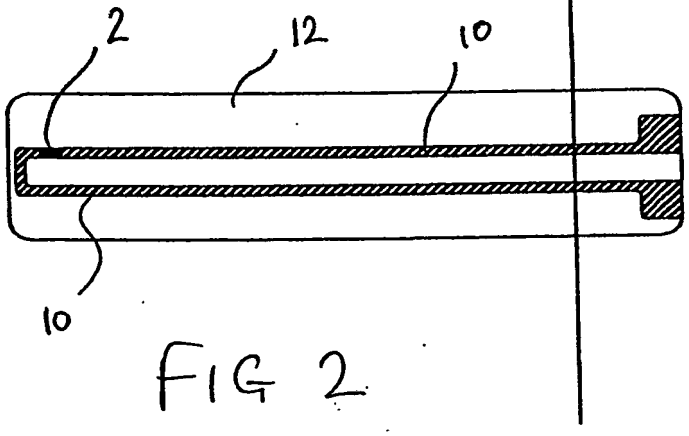

FIG 2

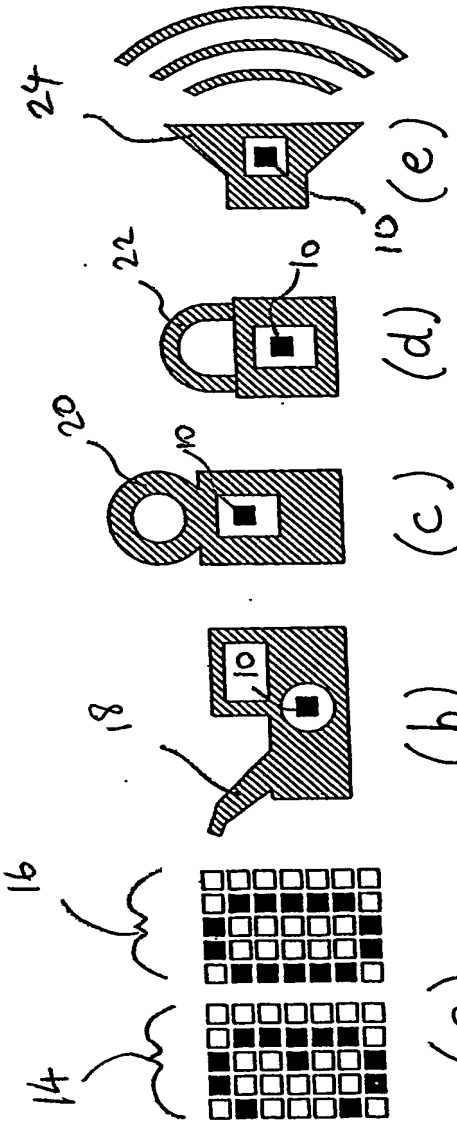

FIG 3